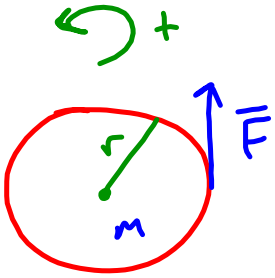
Practice – Rotational Statics and Dynamics

1)



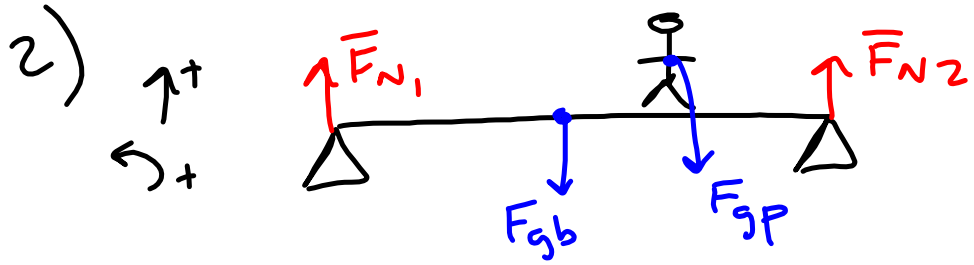
$m = 4\ kg$
$r = 0.18\ m$
$F = 5.0\ N$
$\Delta t = 4\ s$
$\omega_i = 0\ rad/s$

$\omega_f = ?$

$$\omega_f = \omega_i + \alpha \Delta t$$
$$= \alpha \Delta t$$
$$= \frac{2F\Delta t}{mr}$$
$$= \frac{2(5N)(4s)}{(4kg)(0.18m)}$$
$$= 55.6\ rad/s$$
$$= 530\ rpm$$

$$\tau = I\alpha$$
$$\alpha = \frac{\tau}{I}$$
$$= \frac{r F \sin(90^\circ)}{\frac{1}{2} m r^2}$$
$$\alpha = \frac{2F}{mr}$$

2)



$$\Sigma \bar{F}_y = \emptyset$$

$$F_{N1} + F_N - F_{gP} - F_{gb} = \emptyset$$

$$\Sigma \bar{\tau} = \emptyset$$

rotation point is left support

$$r_1 F_{N1} + r_2 F_{N2} - r_b F_{gb} - r_P F_{gP} = \emptyset$$

$$r_2 F_{N2} - r_b F_{gb} - r_P F_{gP} = \emptyset$$

two equations, two unknowns

ALGEBRA!

$$F_{N1} = 751\ N$$

$$F_{N2} = 1013\ N$$

3) $x_{cm} = \frac{(1\,kg)(0\,m) + (2\,kg)(1\,m)}{1\,kg + 2\,kg} = 0.667\,m$

$I = \sum m_i r_i^2 = (1\,kg)(0.667\,m)^2 + (2\,kg)(0.333\,kg)^2$

$= 0.667\,kg \cdot m^2$

ccw = +

$\omega_i = -20\,rpm = -\frac{2}{3}\pi\ rad/s = -2.093\ rad/s$

$\omega_f = 0\ rad/s$

$t = 5\ s$

$\omega_f = \omega_i + \alpha t$

$\alpha = \frac{\omega_f - \omega_i}{t}$

$= \frac{0\ rad/s - (-\frac{2}{3}\pi\ rad/s)}{5\ s}$

$= 0.419\ rad/s^2$

$\tau = I\alpha$

$= (0.667\,kg \cdot m)(0.419\ rad/s^2)$

$= 0.28\ N \cdot m$